STUDENT'S MANUAL.

HASKELL.

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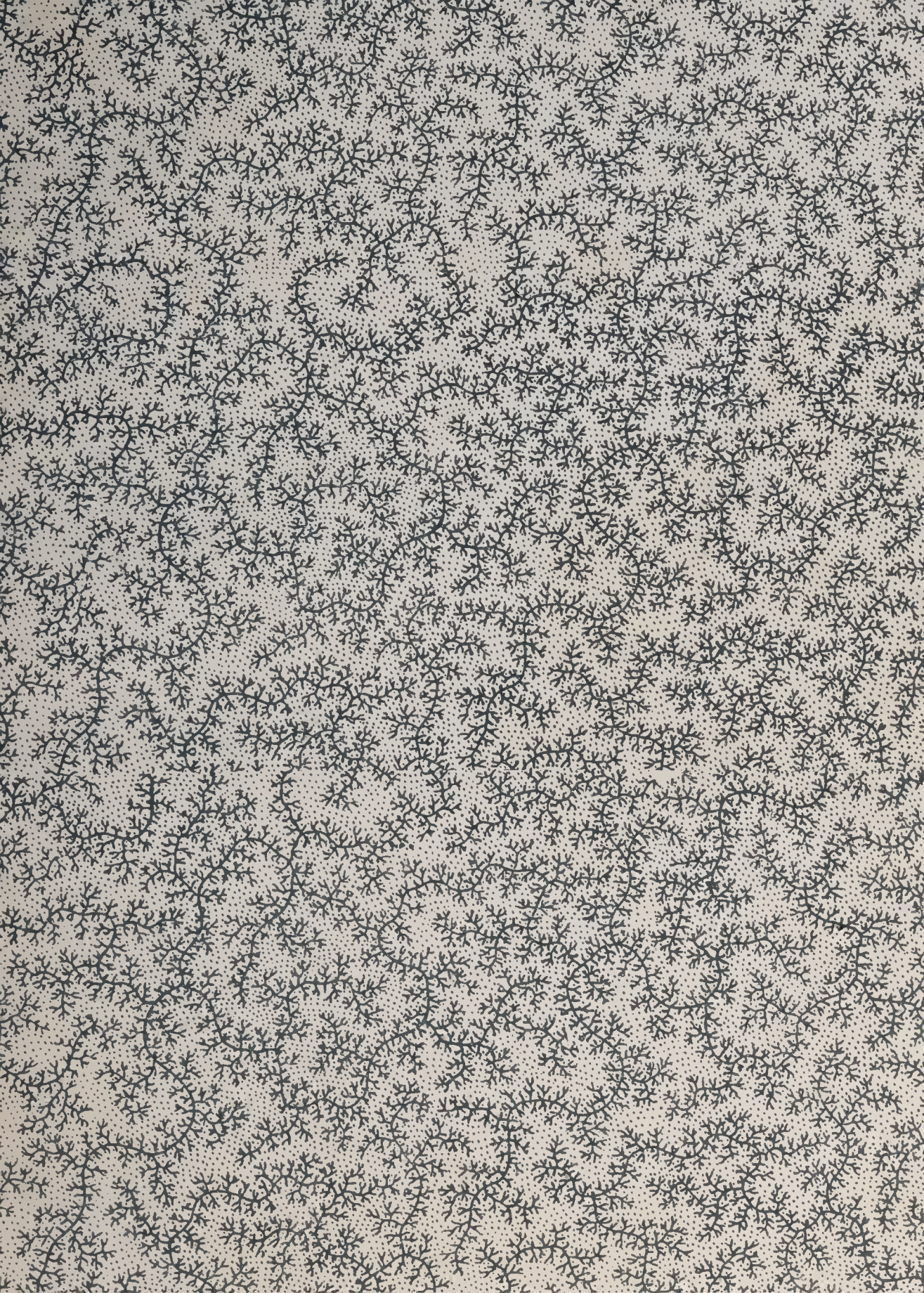

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THE

STUDENT'S MANUAL

AND

HAND-BOOK

FOR THE

DENTAL LABORATORY.

BY

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CONTENTS.

PREFACE.

AT the urgent advice of members of the profession, I have prepared this work, for which there seems to be a place in the laboratory of the young dentist, to say nothing of the older members of the profession, who, in these days of rubber plates, have had little experience in metal work.

The text books are too diffusive, embodying too many methods for the same object, confusing to the student, and inconvenient as hand-books.

This book will embody the result of forty years' experience in the dental laboratory and exclusive attention to prosthetic dentistry, furnishing methods which have been thoroughly demonstrated as simple and effective, producing satisfactory results.

It is not intended to take the place of the text-book in the dental college, though the student will find it there a valuable aid in the prosecution of his preparatory work.

CHAPTER I.

GENERAL PRINCIPLES.

IN examining the mouth for the insertion of an artificial denture, there should be taken into account all its conditions, viz.: the shape of the jaws, long or short, deep or shallow, hard and unyielding, soft and yielding; a solid alveolar ridge, or one from which the bone has been absorbed, leaving a flexible condition; the relative position of the jaws, whether the lower is receding or protruding; and then the remaining teeth, if there are any; for often a few teeth are left, sometimes useful, but often not only useless, but interfering with the comfort and usefulness of the artificial denture. If the patient is better off without them, advise their extraction.

The first object to be attained is comfort and usefulness; next, artistic appearance, or resemblance to nature, not only in the size, shape, color, and arrangement of the teeth, but in forming the artificial gum, be it rubber or porcelain, so as to restore the contour of the lips.

The selection of material for plates, the patient should leave to the dentist, presuming he has been properly educated as to the relative value of each.

Whatever materials and methods will secure the best results should be adopted.

The remark is often made, "I do not have any demand for metal plates." That is true, in consequence of the universal use of rubber, consequently you must create the demand by showing your patients the superiority of the metal, and the disadvantages of the rubber.

CHAPTER II.

THE LABORATORY.

IT should not be a *machine* shop, but adapted to, and arranged for, the object intended.

It should be large enough for all the purposes of a dental laboratory, well lighted, and easy of access from the operating room.

The work-bench should be in front of the window, as it is difficult to work advantageously by a side light. The bench should be of hard wood, about 18 inches wide, $1\frac{1}{2}$ inches thick, and of a proper height to sit down and work at easily.

The gold drawer should be 2 feet long, 18 inches wide, 6 inches deep, with the front cut out in a half circle, so as not to be in the way in filing. In it should be a "gold-pan," 14x10, and $1\frac{1}{2}$ inches deep, with a top depressed in the centre and perforated with small holes for the filings to pass through. There should be a hard-wood knob in the bench over the drawer to file on. If there is plenty of room, a second drawer, with knob, for rubber-work, is desirable, also a drawer for refuse wax, and over which to "wax-up."

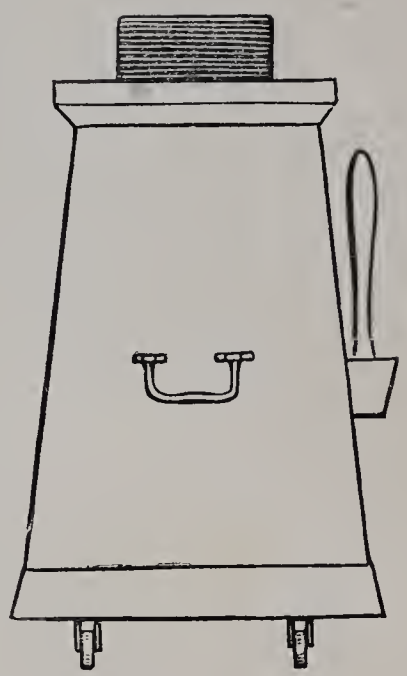
The *plaster-bench* should be constructed with a hole in the centre, for refuse plaster to drop through into a box or barrel; shelf for flasks, and a tin can for plaster.

The *molding-box* may be 18 inches square and 4 inches deep, placed as a permanent fixture, with shelves for flasks, dies, etc.

The lathe should be a permanent fixture on a bench, with good light, and sufficiently high to stand at. A machinist's lathe is not adapted for *dental* purposes, while we have dental lathes admirable in all their appointments. Have a rack for the appliances.

The tools should be arranged at the back of the bench, within easy reach, and never in a drawer. Have in the rack only such as are needed for dental purposes, laying duplicates aside.

A *movable swaging-block*, to be kept under the bench, by the side of gold-drawer, is made as follows:



8 inches wide at the top, and 11 inches at the bottom, just high enough to pass under the bench. Make it of pine, with a plank bottom, to which attach heavy castors, a handle on one side, and a pocket for the hammer. Have an iron six-inch cube cast, and filling the box nearly full of sawdust, place the cube in it so it will extend 2 inches above the box.

If you intend to make continuous-gum work, provision should be made for a furnace.

CHAPTER III.

TOOLS AND APPLIANCES.

DENTAL depots are filled with appliances, many useless, others sometimes useful but not necessary. The following are indispensable:

FOR METAL WORK.

Straight Shears, with openings for the fingers.
Plate Nippers.
Plate Benders, (lower.)

Plate punch.
Hammer, for swaging.
Horn or wood mallet.
Files, round, and half-round.
Small vise and anvil.
Slate, for borax.
Sheet iron soldering pan.
Articulators.
Lathe appliances.
Felts and brushes for polishing.
Acid dish, *lead.*
Sieve.
Molding flask, 5 in. diameter, 3 in. deep, of iron.
Pliers, round-nosed.
Pliers, flat-nosed.
Hammer, riveting.
Plate burnisher.
Tweezers, for solder, etc.
Reamer, for countersink.
Blow-pipe, mouth.
Pumice block for soldering.
Lathe, cone-bearing.
Circular saw, large and small bur, and drills.
Two ladles.
Stick for packing.
Two sizes of rings for counter die.
Gas-pipe so arranged as to be used for soldering, "waxing up," vulcanizing and melting metals.

FOR RUBBER WORK.

Vulcanizer.
Wrenches.
Scraper, round shape.
Small pointed instruments for finishing between the teeth.
Saw-frame and saws.
An instrument for waxing up, straight and pointed at one end, and slightly curved at the other.
Bowls, medium size.
Shellac bottle, (wide mouth.)
Flasks.
Press.
Chisel, with narrow, thin edge, for trimming around necks of teeth.
Calipers.
Files, two grades.
Plaster-knife.
Heavy tea or dessert spoons for mixing and handling plaster.
Oil bottle.

FOR CELLULOID.

All tools used for rubber except vulcanizing flasks and press, substituting celluloid flasks and press.

FOR CONTINUOUS-GUM.

Furnace.
Porcelain Boxes, for mixing material.
Muffles, slides, tongs, and poker.
Camel hair pencils.

Instruments for applying material.	Stiff Brushes.

To the above can be added:

Automatic blow-pipe.	Rolling Mill.
Furnace or melting apparatus.	Tongs for crucible.
Ingot Mold.	Plate gauge.
Cutting pliers.	Curved shears.

BLOW-PIPE, ETC.

Every student should learn to use the mouth blow-pipe.

The first thing to be done is to secure a proper blow-pipe. Those usually sold at the depots are made for jewelers, who solder small objects with a low grade of solder, and not invested as teeth are. The S. S. White Co. and Welch Dental Co. have now blow-pipes made recently, at my suggestion. The mouth aperture is $\frac{5}{8}$ and the small one $\frac{1}{16}$ inch.

The end should not be taken between the lips, as it tires the muscles too much, but pressed against them. There must be a supply of air in the lungs constantly, so do not allow a complete collapse of the diaphragm, at the same time pressing the tongue against the palate to prevent the lips collapsing while drawing in a fresh supply through the nose. A little practice, observing these rules, will soon enable you to use it successfully.

The automatic blow-pipe, operated by foot bellows, is very useful to those who cannot use the mouth blow-pipe.

The proper form of gas jet for soldering is a wire bulb, made by leaving the end of the gas-pipe with no burner and winding over it fine binding-wire, till a bulb about 1 inch in diameter is secured; the same results may be obtained by making a bulb of several thicknesses of fine wire-gauze over the end of the pipe, and bound tightly to it. The object is to break the force of the gas, and add more oxygen to it; in this way, a flame like an alcohol lamp is secured, which can be easily controlled by the blow-pipe, and in heating up, the whole flame can be taken within its scope. The gas fixture should be horizontal, with two lengths, so as to place in the most convenient position while using.

CHAPTER IV.

IMPRESSIONS.

THE success of the artificial denture depends on a correct impression as the foundation for the work, therefore care should be taken to insure success. As to materials, I differ with many instructors. In some cases, good impressions can be taken in wax, more in the modeling compound, but plaster is a material always to be relied on. It may be accepted as an axiom that the more difficult the case to obtain an impression of, the greater need of plaster.

For a *Full Upper*, spread a large napkin over the dress; select a cup as near the size of the jaw as possible; as it is necessary to obtain a high impression over the cuspids, place a little wax over the outside of the cup at those points, also over the posterior corners, if the process is deep, and raise the palatal surface at the rear a little, if the arch is deep.

Mix the plaster to the consistency of thick cream, and add a pinch of salt, at the last moment, after the plaster is ready, as you do not want to hasten the setting till after placing in the mouth; stand at the right side, and with the left hand distending the lips, press the rear of the cup into place, and so, forcing any excess forward, press the cup full into place, at the same time telling the patient to "keep the tongue quiet, and not to be concerned about what runs over at the rear," then pressing the lip so as to force the plaster well up under it. If there is nausea, tell the patient to *resist* the tendency, as it will be over in a few moments. As soon as the plaster has set, which can be ascertained by breaking off a piece of the surplus in front, remove by raising the lip high, and working the impression so as to let in the air.

For a *Full Lower*, proceed as above, only standing *in front* of the patient, and as the cup is passed into place, press the cheeks away from the cup, so there shall not be a fold of membrane underneath.

For a *Partial Lower*, with the anterior teeth remain-

ing, select a cup with an opening for the teeth, and through which they will pass easily. Wet a piece of paper and lay over the opening, and, holding the cup in the palm of the hand, put in the plaster, and place in the mouth, always pressing away the plaster from the front before inserting, so as to have as little outside of the teeth as possible, as it will facilitate its removal. If there are molars remaining, so that the sides of the cup will not go deep enough, place wax on the outer edges. Sometimes the teeth stand in such a position that the plaster must, of necessity, break; this is of little importance, as the pieces will readily go together again.

For a *Partial Upper*, proceed as with a full upper, only, before inserting, press away the plaster from the sides of the cup where there are teeth, as there will be enough to go outside. *Do not let the plaster set as hard* as in full cases, or the cup will leave the impression, and the plaster have to be broken away in pieces. This can always be avoided, and should be, as it is very unpleasant for the patient.

Never take an impression in wax, and then plaster in it, for while the plaster will break just the same, it will often be difficult to replace, or even save the pieces, when they are thin; there is nothing to be gained by it. Be sure your impression is good before dismissing the patient. It is a simple process, only avoid using an excess of plaster, and too large a cup.

CHAPTER V.

PLASTER CASTS.

WHILE there are various methods of preparing the impression, I much prefer shellacking, always using it thin, so it will strike in, and not make a skin on the surface. By shellacking, it is easy to tell what is cast and what is impression, when separating. Next, oil lightly, and turn the impression *down* while mixing the plaster. Mix the plaster the same as for the impression, about the consistency of thick cream; place but little in the impression, at first, and jar thoroughly so as to drive out all air. When hard, remove the cup, and with a sharp knife, pare the impression to near the teeth, if there are any, or to the cast. With a blunt-pointed knife, proceed to break it away, beginning at the heel and pressing with the thumb to guard against the knife going into the cast.

For a full upper, make the following changes in the cast. In most cases, the palate is hard in the centre, and as the rest of the surface will yield invariably to pressure, the plate will bear hard and irritate, and rock. Therefore relief should be provided by raising the plate where the palatal bone is hard. If it is to be a rubber plate, scrape a portion from the plate

when finishing. For a metal plate, it is better to raise with a *thin* film of wax along the entire hard palate, about $\frac{1}{16}$ inch in depth, graduating to the edges so as to show no line. The amount of surface thus covered will vary in different mouths; some quite wide, others narrow. At each side of the hard palate, at the posterior edge of the plate, *scrape* the cast slightly, so the plate will hug snugly there (Fig. 2.)

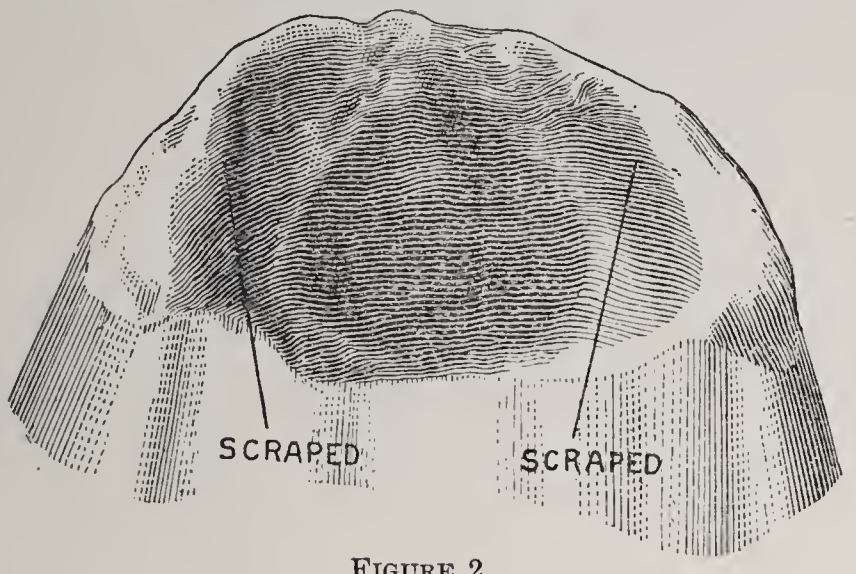


FIGURE 2.

If there is a *flexible* ridge in front, its normal condition is where the plate which has been worn has pressed it, and there it should remain, for no change of position will improve it; it would be better if the patient would submit to its removal.

No air chambers are needed in full plates. If the plate comes in close contact with the membrane, there will be all the adhesion necessary to sustain the heaviest work.

Mix plaster, spread on a smooth surface, and set the cast into it, so as to make the whole about $1\frac{1}{2}$ inches high; if the cast is *slightly* under-cut, *raise the front* a little, and then form the plaster around the sides so as to have them flaring. The object is to facilitate the removal of the cast from the mold, as it will deliver itself better than if removed with the fingers.

If the case is badly *undercut*, either in front or at the posterior corners, make a "core" (Fig. 3) as fol-

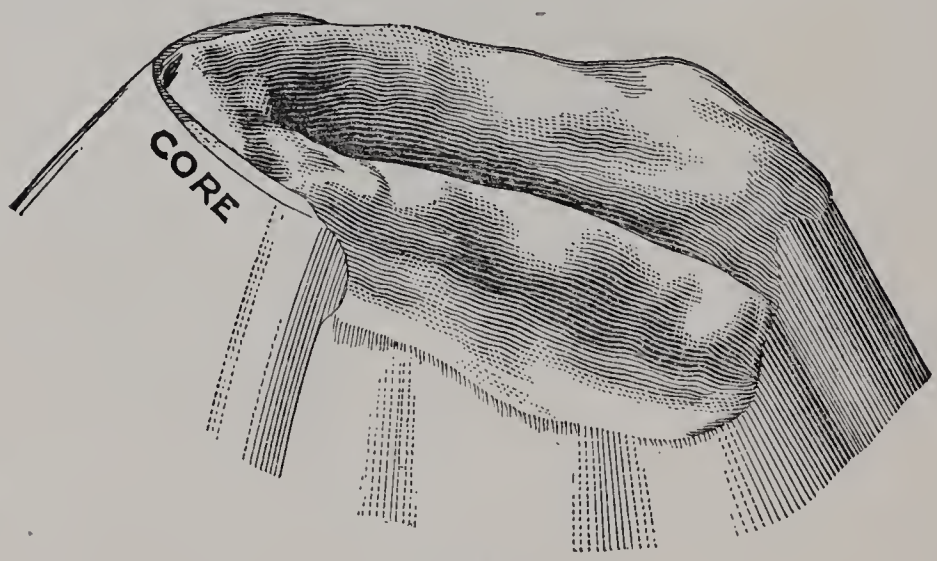


FIGURE 3.

lows: Set the cast, after it is ready for molding, on a smooth surface; oil the surface, where under-cut; mix plaster and asbestos, equal parts, and lay on the surface $\frac{1}{4}$ inch wide at the base, up to the top of the cast; when hard, remove, trim, and dry *perfectly* for molding.

For full lower, prepare for molding as above, hav-

ing, previously to filling the impression, *removed a little from the surface of it, in the extreme depression*, or what represents the summit of the jaw, so the plate will set more easily.

If the *lower* case, either full or partial, is badly under-cut, make a "*core*," in two sections, one transversely across the heel to past the cuspid, and the other to lap on to this one. In this way a perfect die may be obtained (Fig. 4).

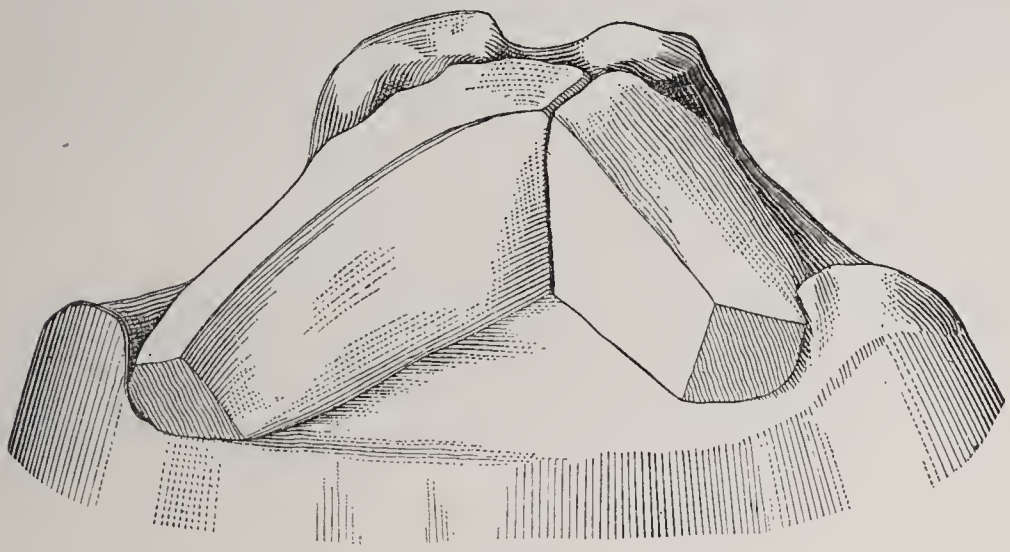


FIGURE 4.

If it be a *partial lower*, leave the anterior teeth on the cast, building up with plaster against the front to have the cast flare, cutting off all other teeth from the cast.

For *partial uppers* cut off all teeth. If for *suction*, relieve the hard centre, as in full sets; or if deemed best, put in an "air-chamber." Some patients will wear a plate without, others will think they cannot.

CHAPTER VI.

DIES.

THE qualities requisite for a dental die are these: *non-shrinking; hard,* so as not to batter in swaging; *cohesive,* so as not to break; furnishing a *smooth surface; fusing at a low temperature.*

Babbitt metal is the only alloy that furnishes all of these qualities. My use of it for 35 years has fully demonstrated its complete adaptability to this use. But as there are many formulas, it is important to have one suited to this purpose. This is, copper 1 part, antimony 2 parts, tin 8 parts. These should be melted in the order named, as tin would oxidize badly before the first was melted if all were placed in the crucible together. As a strong heat is required, it is well to use a furnace, or a blacksmith's forge. Melt and turn off into ingots, and re-melt. Babbitt, made from this formula, can be had of the leading dental supply manufacturers. If it should not be found to run freely from the ladle, when making a die, add some tin.

For Counter Dies. As lead fuses at a higher temperature than Babbitt, and would adhere to it when the lead was poured on it, you must reduce the melting temperature by the addition of tin,—5 parts lead,

1 part tin; this also hardens it, which is an advantage, as lead is too soft.

The use of *oiled* sand will be found an advantage, because it can be used a great many times, when properly prepared, avoids bubbling and other delays incidental to wetting sand, to say nothing of the annoyance incidental to the use of it.

Use sweet oil, making the sand of the same consistency as when wet. If too much is in, add more sand. Avoid the use of sand which is very fine.

The molding-box, ring, and flasks have been described in a previous chapter (II.). It is necessary to sift the sand only after using several times, and then only on the surface of the model. Pack hard at first around the sides, so the sand will not drop out of the ring, and then gradually adding and packing till full. In most cases, the model will drop when lifting the mold. If it does not, jar the edge of the ring on the edge of the molding-box. A potato-masher is well adapted for packing the sand, using the small end for the sides, and large end for the top.

It is a good plan to rub pulverized soap-stone on the model before molding, especially when the sand is first used.

Melt the Babbitt, and do not pour when very hot, but stir till it has cooled a little, so it will not burn the sand much.

Be careful not to injure the metal by over-heating

it. Do not cool the die suddenly in water, as it tends to make it brittle.

After it is cool, coat with whiting, wetting and rubbing it on with the finger. Set it into the sand *half* its depth; place a small ring or flask around it; melt the lead and turn, but do not fill the ring full, leaving space to grasp it with pliers, and plunge into water. It is never necessary to swage in the ring.

In molding an *under-cut* case, put the "core" carefully in place, and mold as before; the whole will drop out; replace carefully the core, mold, and cast.

When cores are needed at the posterior corners, or in lower cases, *before making the counter die,* pack a little sand into the under-cut, so the die and counter will separate; then, after the plate has been partially swaged, bring the plate into place in the under-cut with the burnisher, or, if necessary, with a round-faced hammer.

It is sometimes necessary to make a second die, but not generally where Babbitt is used.

If the case has a deep arch, make a *half* counter, just filling the arch, and not extending on the ridge; by so doing there is less danger of tearing the plate in the arch, when swaging.

CHAPTER VII.

SWAGING PLATES.

CUT a pattern for the desired plate; for this there is nothing so good as Japan tea-chest lead; it is thicker and stronger than the Chinese.

The grain of the plate should always be *crosswise* of the die, as in the swaging there is far less danger of its tearing, and, of course, is stronger in wear.

Oil the dies to prevent, as far as may be, base metal from adhering to the plate; if metal adheres, wipe it off, as it will eat into the plate when heating.

Anneal by heating to redness; as the surface oxidizes, clean by dropping while hot into equal parts water and sulphuric acid. For an acid *dish* there is nothing so good as *lead;* it is easily made by forming it of thick sheet lead, over anything of proper size, about 4 inches diameter, 1 inch deep, with a handle cut in the same piece. Sulphuric acid can be boiled in these, and they will last for years.

If the case is a *full upper*, use the mallet in the arch, and if deep, swage with the *half* counter; the bending pliers (lower always) will be found of value in shaping the ridge; to save time, and against which there is no possible objection, cut the edge of the

plate in front, *lap*, and after fully swaging, solder. If the plate is soft, like 20 karat, or platina, twice annealing is sufficient, ordinarily; always cleanse in the acid *after* annealing. There is danger of *over-swaging*.

If the case is *under-cut*, after full swaging, place on the plaster cast and burnish into the depression more fully. With the Babbitt metal die it will be seen that the plate fits the plaster cast snugly, so much so that sometimes it will not come full up to the cast in the centre; it will however, come to its bearings at that point in the mouth.

To aid in restoring the contour of the lip, trim always so as to have the highest points over the cuspids, but drop suddenly back of those points so as to give free play to the muscles (Fig. 5). The plate can

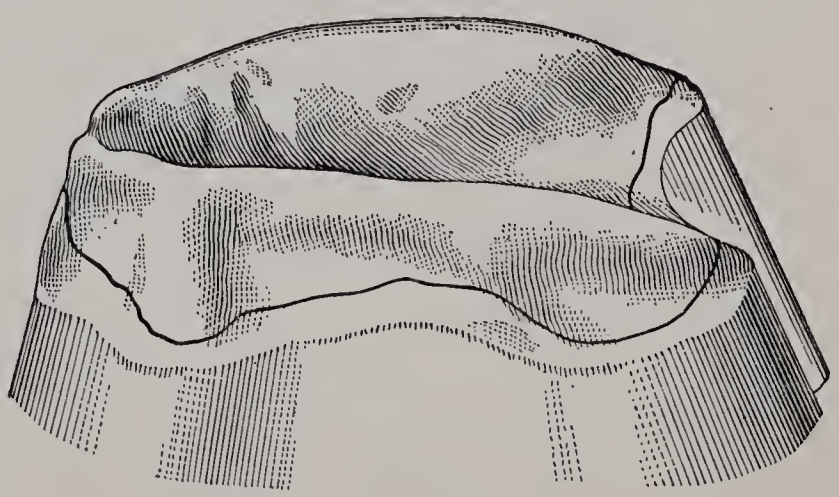


FIGURE 5.

seldom be worn as high as the impression indicates back of these points, but leave the plate high enough, so that on trying in, it can be trimmed as desired. Be sure there is room for the frænum by cutting or filing an opening for it. Always extend the plate over the maxillary tuberosities, however large, as it aids in keeping the plate in place, preventing its slipping forward.

The edge of a plate should never be swaged to form a "rim," because the edge should be left for trimming by the mouth. If a rim or binding is needed, solder one on; it is easily done, and looks better.

In swaging a *lower plate*, use the bending pliers first. If the gum is flat, it is well to swage in two pieces, overlapping at least an inch, thus *doubling* the plate where it needs strengthening.

In trimming a lower plate, it should be remembered that much trouble arises from its being made too deep, so as to infringe on the muscles and loose integument. The plate is thus lifted by them, and they in return are irritated by the plate.

In swaging a *partial lower*, the plate should be swaged in two pieces, as it facilitates the process, and doubles it where needed. Cut each pattern so as to extend from the posterior to ½ inch beyond the cuspid, or bicuspid if any remain. Always carry the plate *above the necks* of the teeth, about half way, as often the attachment of the muscle is so high it necessitates

making the plate very narrow, unless it is carried higher, and it will set firmer for so doing.

Swage each piece separate, and then swage together, putting borax between; clamp with small wire clamps (hair pins make good ones); one of the pieces will usually overlap the other, or if it does not, both may need trimming; trim one, leaving the overlap on the other till after soldering, so as to lay the solder on the overlap, drawing through till it can be seen on the other edge.

In swaging a *partial upper*, use the mallet first, and the bending pliers if needed.

If it is to be a clasp-plate, extend the plate $\frac{1}{4}$ inch beyond the tooth to be clasped, as the plate will set steadier. Double around weak points, either each tooth separately, or in one piece $\frac{1}{4}$ inch wide around the whole plate, laying the solder on the overlapping points, and drawing through; as, if lain on the inner edge, there is danger of flowing it on the plate. It is never well to double the whole plate.

CHAPTER VIII.

FITTING PLATES.

IN the full upper plate, see that it sets steady. If the ridge is flexible, it must inevitably yield to pressure. The point of great importance is at the posterior margin, in the centre. See that it sets close enough to exclude the air. This can be done by wetting it before placing in the mouth, and then by a pumping process, watching for the escape of air-bubbles. It is equally necessary to see that it does not press so hard at that point as to irritate, and then loosen; this is often the case.

After trimming the outer margin, turn, with the pliers, the extreme edge about $\frac{1}{32}$ of an inch, to guard against irritation. Plates can be worn higher than many dentists imagine, judging by the way they are usually trimmed. They should be worn as high as possible, especially over the cuspids.

In fitting a partial upper plate, see that it does not infringe on the necks of the teeth, wearing, making them sore, and displacing them, and preventing the plate coming to its place on the membrane.

In fitting a full lower plate, see that it sets steady; have the patient raise the tongue to the palate, and

see if it lifts the plate; then lift the lip in front and at the sides, and if there is interference, trim accordingly.

In fitting a partial lower, see that it does not press hard against the teeth, but lays easily, and observe the rules in the *full* lower.

Always be satisfied that your plates fit before taking further steps.

CHAPTER IX.

CLASPS.

THE use of clasps is not objectionable if properly adapted, and kept clean. Often, when bridge work is used, a nicely adjusted narrow plate, properly clasped, would be far less objectionable than permanent fixtures, saving, instead of destroying, the teeth attached to.

Clasps should not be so wide as to cover a large portion of the tooth, being cumbersome, and looking badly. Neither should they be very narrow, as is the custom with English dentists, as they wear into the enamel.

As a rule, about $\frac{1}{8}$ to $\frac{3}{16}$ inch wide is sufficient. The material should be 18 karat alloyed with platina, so as to be springy; in thickness about 24 gauge.

In selecting teeth for clasping, the second bicuspids are preferable, if the way is clear for using them, because of their straight sides, and being in a position to sustain the plate in balance. The *first* bicuspid is to be chosen, if there is no second, especially if there is to be a small plate of few teeth. The first molar next, especially if it is a large plate.

It is not advisable, except in rare instances, to wedge or file teeth for the purpose of using clasps.

If those to be clasped to are the only teeth left of the upper set, the danger that eventually they may be lost would indicate the advisability of making a suction plate, so that the plate would still be useful, but while they remain, use them to steady the plate in mastication.

Fit the clasps to the plaster teeth as accurately as possible; then fit them to the natural teeth; if the clasp is on a bicuspid, do not let it pass in the front if it can pass around the back; in other words avoid its showing if possible. If it is on a molar, and can pass all around, let the ends meet at the labial surface. After fitting, press open slightly so as to remove easily; with wax firmly attached to the plate, unite the two, and, placing in the mouth, press both into place, and carefully remove. Invest the clasp and a small portion of the plate in plaster and pumice; warm and remove the wax; fasten the plate and investment together with a wire clamp, so that they may not

become separated while heating; if there is a space between the clasp and plate, as it is sometimes not advisable to put the clasp high up on the tooth, put a piece of gold in when soldering the clasp to the plate. Never unite them for a space of more than one-eighth to three-sixteenths of an inch, thus leaving full play for the elasticity of the clasp. To prevent the solder flowing beyond this point, put plaster into the joint.

Adjust but one clasp at a time, and round and thin the ends slightly in finishing.

CHAPTER IX.

INVESTING, BACKING, SOLDERING.

IT is well to have several sizes of sheet-iron rings, one inch deep, to invest in. Select one a little larger than the case, then there will not be superfluous plaster to heat up and keep hot; and the case is secure from accident in handling.

Mix equal parts of plaster and sand (some use asbestos, but it is more expensive, and is not so solid to back-up in). Be sure it comes in contact with the plate, for if there is a space underneath, there will be danger of melting a hole in it. When hard, warm

and remove the wax, then, setting it in the sink, dash hot water on it.

I prefer backing in the investment, as it avoids the necessity of investing separately and heating up and soldering twice, and it can be done as well as by the other method.

For backing, the gold should be thicker than the plate. I use *clasp* material. Cut off a strip the width of the teeth; shape the end to the plate; put coloring, ink, or other material, on the head of the pin, and press the gold on it, and punch; enlarge the surface of the opening with a small "countersink;" if it is a back tooth, cut off the gold even with the crown; if a front tooth, it looks better a little shorter, with the ends rounded and chamfered. If they are gum teeth, shape to the shoulder on the gum, and let them meet only at that point. If plain teeth, do not let them meet at all. After it is fitted, bend slightly so it will fit snugly, and with a sharp chisel-shaped instrument split the head of the pin; it is better never to rivet, as if only split the solder will flow around the pin in the hole, and fasten more securely than riveting. It is well to cut off the head of the pin, if too long, before putting on the backing.

If there are spaces under the teeth, fill with foil. These should be avoided, as far as possible, by close grinding.

See that the surface of the plate is clean; mix pul-

verized borax on a slate or glass, having it sufficiently wet to spread easily; I prefer for use a thin stick. Cut the solder small and lay it where you wish it to flow. Place it to heat over the gas, and let it heat slowly for fifteen minutes, then turn on the full heat, and when as hot as that will make it, place in a small soldering pan (Fig. 6), and throw a full blast on it,

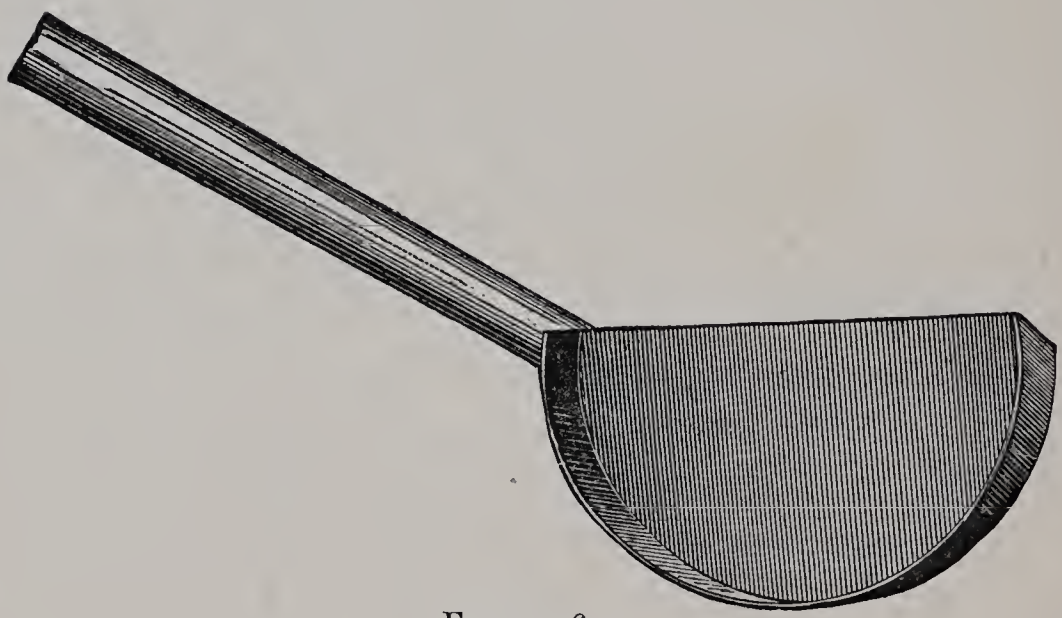


FIGURE 6.

heating *equally* plate and backing, till the solder flows. If the solder is what it should be, it will sweat down where it lays and blend in with the plate. To insure this, the solder should be of the same karat as the plate, 18 to 20. The nearer the melting point of the plate, the better the results and the less labor in finishing.

The entire surface of the plate should be exposed. If it is a lower partial, cut out the plaster in the centre entirely, so there will be an opening to prevent the flame rebounding.

CHAPTER XI.

FINISHING METAL PLATES.

AS soon as cool, place in water to soften, and remove the investment, and place in the acid to boil; then clean the plate and removes the borax. Next place the plate in a solution of soda to remove the acid from under the teeth.

With the file remove all sharp corners and edges; with fine, small corundum smooth the surface over the pins and wherever the solder has not flowed properly.

Drive a pine stick into the chuck hole of the lathe, and with a sharp pocket knife turn it to a round point; then with pumice finish the entire surface, following with *small-sized, soft* brush-wheels, and finally with whiting or rouge.

CHAPTER XII.

PREPARATIONS OF METALS AND MAKING SOLDERS.

IF a dental depot is easy of access, better buy than prepare plate and solder; jewelers are not as expert in preparing them.

Gold plates of a lower karat than 18 should never be used; I prefer 20. It should be made with pure gold alloyed with pure copper and silver, one part of the former to two of the latter. For 20 karat, 1 ounce of gold and 4 dwt. of the alloy; for 18 karat, 1 ounce of gold and 6 dwt. of the alloy.

Place in a crucible with plenty of borax, and melt, and turn into the ingot mold. Roll lengthwise to the necessary *width* of plate; then anneal, and roll to gauge 28, which is a suitable thickness for all plates, except lower, which should be thicker, additional strength in special cases being obtained by doubling.

To Dispose of Scraps, Filings, and Old Plates.—Save all clean scraps and portions of old plates that are free from backings, clasps, and solder, and melt. All else, including filings, through which a small horseshoe magnet has been passed to remove steel particles, should be subjected to a strong heat with saltpetre. If it does not come out tough, subject it to corrosive sublimate. If this does not do,

send to an expert. This product usually has enough platina in it for clasp and backing material.

To make *clasp gold*, take 20 karat plate and add 2 dwts. platina. Melt the gold, and, rolling the platina as thin as possible, drop into the gold when melted. The gold acts as a flux, and the platina is melted.

Gold Solder.—The leading dental depots provide now an admirable quality of solder. But if you wish to make it, the following recipe, by an old expert, Dr. D. H. Goodno, makes a solder that has all the qualities desired, being remarkably tough, flows readily, and does not discolor in the mouth. He says he has rolled it as thin as a ribbon of pure gold: 40 grains pure gold, 2½ grains pure silver, 2½ grains pure copper, 3 grains pure zinc; roll the zinc in gold foil and place in the bottom of the crucible; cover with borax; cut the other material fine and place in the crucible, and cover with borax; melt and roll.

Another recipe is made as follows, by first making an alloy: 3 dwts. pure silver, 3 dwts. pure copper, 1½ dwts. pure zinc. Roll the zinc in gold foil and place in the crucible, and cover with borax; place the copper and silver on it and cover with borax, and melt; roll thin, and use according to the karat you wish; for 20 karat 5 dwts. pure gold, 1 dwt. alloy; for 18 karat (and there is no necessity for using a lower karat in the mouth), 5 dwts. gold, 1½ dwts. alloy. Always test your solder by flowing on silver plate.

SILVER.—For partial sets, when the patient cannot afford gold, silver makes a good substitute. But coin silver should never be used, as it oxidizes badly in the mouth. Pure silver, alloyed with platina, makes a good plate, which, of course, discolors from the presence of sulphuretted hydrogen in the mouth, but is easily cleaned; 2 dwts. of platina to the ounce of silver is sufficient.

For clasps for silver plate use gold; and I prefer to solder with gold, using 18 karat. *Silver solder* is made as follows: Silver, 6 parts; copper, 3 parts; zinc, 2 parts; melting the copper and silver and then adding the zinc.

CHAPTER XIII.

ATTACHMENT OF TEETH TO PLATES.

AS a rule, in partial sets, the teeth should be backed and soldered.

In *full upper sets*, it is no longer necessary to use the single gum teeth, and it is not advisable, for it is impossible, with them, to secure proper arrangement, articulation, and restoration of contour; besides, the work is not cleanly, on account of secretions getting between the teeth and plate. By using single plain

teeth, and pink rubber attachments, the best results can be attained, next to continuous-gum.

For *partial lower* on gold, this method is the best, for the reasons mentioned, and also because there is such a tendency of the process to give way, in these cases, that it is necessary, from time to time, to remove the teeth and set them higher, and this, of course, is easily done, if the rubber attachment is used.

Sometimes partial uppers may be constructed in the same manner, especially when all the back teeth are replaced.

The method of attaching is to invest the case, as if it were to be a rubber plate; then solder *platina loops* at intervals on the plate; the loops may be $\frac{1}{16}$ inch wide, $\frac{1}{4}$ inch long, soldering the ends, or soldering the middle with the ends turned up. In an upper case put four such near the upper edge and four on the ridge.

After soldering on the loops, place the flasks together, and see that none of the teeth come in contact with the loops so as to prevent closure of flask.

Another method is to *spur* the surface with a sharp instrument; this, however, cannot always be relied on, but deep spurs in the cast metal plate are sufficient.

CHAPTER XIV.

RELATIVE VALUE OF THE VARIOUS MATERIALS FOR PLATES.

FOR full upper sets, continuous-gum stands pre-eminently the most perfect, in all respects, of anything ever devised, provided it is made as it ought to be, and full advantage taken of its capabilities. It most nearly resembles nature, not only in the arrangement of the teeth, but in the disposal of the gum and imitation of the palate; it is the most cleanly, and the materials are in no way objectionable in the mouth; it is generally the strongest. More than thirty years' use has demonstrated the truth of these statements.

Next in value for *full upper* and in nearly all *partial* cases is gold. This has been used from the earliest history of artificial dentures, and has been fully tested.

Next in order for full uppers may be mentioned platina, with rubber attachments.

For *partial* uppers some use platina; but if it is pure it is too soft for the purpose; it may, however, be alloyed with iridium.

For *partial lower* gold is the best, with exceptional cases, when rubber (the black or the maroon) is perhaps better.

For full lower sets, where the gums show, which is rare, continuous-gum should be used. However, in many cases, nothing is better than the *cast metal* plates, with rubber attachments, using Watts', Weston's, or Reese's metal.

Aluminum is used to some extent, but is objectionable for several reasons. If the plate should crack from any cause, there is no solder suitable for the mouth with which to repair; often there are iron spots in it, which rust through, making holes. Recently, however, a method of casting these plates has been devised, which promises good results.

Next in order is rubber, used the world over more than any other material. But while thus used, it is open to serious objections, doing, in many cases, much harm to the mouth; a subject it is not necessary to discuss here.

It is not, however, an unmixed evil; it enables many people to wear artificial teeth who would otherwise be unable to afford them; then for temporary work it answers every purpose; in some cases for partial lower it is well to use it.

The last on the list, celluloid, is the least in value; having given it a thorough trial for six years, I was compelled to abandon it. I could not recommend it to my patients longer. The objections to it are those pertaining to rubber, besides being more uncleanly,

absorbing the secretions. It is difficult to repair, and is injured in appearance by the process.

There is still another material, the porcelain plate. But to make this requires long practice, and even then it is impossible to secure all the results necessary for a perfect artistic denture. When done it is always difficult to repair, and sometimes impossible. I do not, however, condemn it.

COMBINATION WORK.

There is but one kind of "combination work" that is advisable, and that is metal plates and rubber attachments.

The combination of continuous-gum on a rubber base was made quite extensively twenty-five years ago, and, as might have been expected, was abandoned. It, however, came to light again across the Atlantic a few years since.

The objection to it is the difficulty of repair. If a tooth is broken, the continuous-gum portion must be removed and repaired, and a new rubber plate made, involving too much expense for the replacement of a tooth. The same objection holds good in continuous-gum and cast metal plates.

The combination of rubber and celluloid is a difficult kind of work to make, for which a good price should be charged, and then the price charged would have paid for a metal plate, which would have been far preferable.

The combination of celluloid and gold is objectionable, for the reasons that apply to the celluloid alone, and also that the celluloid does not adhere to the plate, and in case of repair is just about ruined.

CHAPTER XV.

CONTINUOUS-GUM.

THIS is the most difficult to make, and yet the most perfect when completed. It has stood the test of time, and remains to-day unparalleled as an artificial denture. I do not see how there can be anything superior to it, at least in its adaptation, where a porcelain gum is an absolute necessity, but which must be very high, and very thin, with no seams.

There cannot be too much care bestowed on its construction, and it amply repays the careful operator who avails himself of all its possibilities, for with this work the shape of the teeth can be modified by grinding, or building on to, and when the work is finished the teeth when ground, are re-enameled.

The plate should be swaged the same as for gold, using the best French plate, gauge 28. After fitting,

and articulating bite secured, place in the articulator and remove the wax.

With lead make a pattern about ¼ inch wide, covering the entire posterior of the plate, and around the corners. This is for a "doubler," and should be gauge 30. First swaging in the dies, fit with the burnisher, and turn up the inner edge slightly to the top of the tuberosity; clamp in the center, after putting in a little borax; solder (always using pure gold, as alloyed gold would discolor the gum in baking) for about ½ inch; removing the clamps, replace on the model, and burnish again closely, and clamping, solder still farther, and so continue, by degrees.

Take round wire, gauge 18 and *roll* to gauge 21. File one edge flat, and beginning where the inner edge of the doubler is turned up, fit the wire with pliers for the distance of 1½ inches, clamp and solder only ¼ inch; then place on the model, and fit *closely*, a short distance each way, and solder again, and so on till it is all attached.

The teeth being arranged, insert in equal parts plaster and asbestos, leaving it about ½ inch thick underneath and all around.

When hard, warm slightly and remove the wax, finally dashing boiling water into it, so as to thoroughly cleanse of wax.

Turning up the pins, make three patterns, one each

covering the molars, bicuspids, and cuspids, with a foot-piece $\frac{3}{16}$ inch wide resting on the plate; and one piece covering the six front teeth. Use the backings same thickness of the plate; cut the edges for foot pieces in slits, the width of foot-piece, and turn at right-angles, and with an instrument (I use a worn-out scraper) press into place, under the pins. The front piece, of course, will lap over the side pieces, *on the cuspids.* Have the pure gold rolled very thin, cut in small pieces, and lay underneath the foot-piece, and a piece under each pin as it is turned down, pressing the backing snugly to the plate; *use no borax.*

I prefer soldering in the furnace, the first thing after the fire is made. It can be done, however, with a bellows blow-pipe.

After cooling, remove the investment, *saving the base;* wash thoroughly, and there is no need of boiling in acid. Place on the model, and press into place; see by the articulator if the position of any of the teeth has been changed, and if so, correct.

The only instrument needed for applying the body as used is a wax-knife, straight and pointed at one end, and slightly curved and pointed at the other. (Fig. 8.)

FIGURE 8.

In addition to this there is required a quill tooth-pick, camel's-hair brush, a stiff dry brush, a set of boxes, setting one into the other (used by artists), a spatula, a small cloth for absorbing, and a small glass of water.

The materials, body and gum, are ready prepared, and sold at the dental depots. I have always used that made by S. L. Close.

Apply the body, which has been moistened so as to be quite thin, with the flat end of the instrument to the outside; beginning at one end, work it thoroughly under and around the teeth, by jarring; then absorbing with the cloth, apply more, after having thickened it somewhat; continue this process, jarring and absorbing, then pressing hard; when built up sufficiently, dry partially over the gas or lamp, contouring the gums and trimming around the necks of the teeth. Then apply to the palatal surface in the same manner with the curved end of the instrument, but thin; brush all particles from the teeth or plate; set on the *base* which has been saved from the investment, place on a slide and run into the furnace gradually on a sheet-iron shelf attached to the furnace, occupying perhaps half an hour, the heat meantime coming up, so that when the case is in the furnace and the muffle closed, there is a baking heat. The proper amount of heat must be judged by the appearance of the body, it having a glossy look; place in a cooling

muffle and close, remaining till cool. Care of course, must be taken not to *over-bake*. The baking is not easily learned except through personal instruction, and must be closely watched.

It will be found that the body has shrunk, and left crevices, which must be filled up thoroughly, and the surface built up to the proper contour again, and at this stage the *rugæ* may be formed. The case is again run into the muffle slowly, as before, and baked. After cooling, the gum enamel is applied. This is done with the same instrument as the body, but care is required to put on a uniform coat, with proper shadings; and unless properly done it is liable to curl up from the body. It is baked the same as the body and with the same test.

After cooling, file the binding even with the enamel, rounding the edge of plate and binding; file the doubler wherever it can be reached, and use a small fine corundum over its whole surface. Then finish with pumice and pine stick and polishing brushes. In making a lower set, do not put on a wire, nor turn the edge, but *double* the edge $\frac{1}{8}$ inch wide all around, and let the material extend to the edge.

Repairing is easily done, with a little experience. First invest the entire case $\frac{1}{2}$ inch thick in asbestos and plaster, and place in the back of the muffle before lighting the fire, allowing the heat to come up slowly, and the case to remain till red; cool, and remove in-

vestment, saving the base. Grind out the remains of tooth or teeth to be replaced, as also some of the gum, outside and inside; select the teeth (rubber teeth will do), and fit them to their places. If there is but one in a place, it can be held there with the body (which should be of a lower fusing quality), applied carefully and dried. If there are several teeth, arrange with a little wax, and then over the ends, and also on one or two adjoining teeth, place a thin coating of plaster and asbestos; remove all wax, and pack the body around, quite thin at first, and run the case into the muffle somewhat more slowly than a new case. It will not require as much heat. After cooling, place gum where needed, and bake.

Sometimes the grinding surfaces of the molars and bicuspids appear rough after baking; it is from the presence of lime, coming from the secretions of the mouth; smooth by the use of sandpaper.

If "blisters" appear, grind into them, and fill with repairing body, and enamel over it.

For *furnace*, both the coke, and gas and "hydrocarbon" are being used. For some reasons I prefer and use the coke furnace. I like a large-sized muffle; it is more convenient to work in. I have always used the large-sized Philadelphia furnace, taking a 14-inch muffle. I arrange the bars so as to dispense with the bottom, and pull the bars to drop the ashes. The furnace should be arranged with a shelf in front of

the muffle, on which to place the work for slow entrance into it. The muffle should be luted with fire-clay only at the front, leaving the rear free, as there will be less danger of its cracking across the middle from shrinkage in a high heat.

The clinkers should, from time to time, be removed from the sides of the furnace with a cold-chisel, striking sudden blows, so as not to injure the lining.

Tees' Lilliput Furnace I have used often in demonstrating. It works nicely; my principal objection to it is that the muffles are small and thin.

There is a hydro-carbon furnace, made by Hoskins, Chicago, which does good work: the heating arrangement may also be used for a melting furnace, for refining gold, etc.

The Verrier Gas Furnace is very objectionable for two reasons—its constant liability to "gas" the work, and the lilliputian dimensions of the muffle; some sets could not be put into it.

The most perfect gas furnace is C. H. Land's, of Detroit. He claims there is no liability to "gasing" in its use. (Send for illustration and full descriptive circulars to Dr. Land, or to Welch Dental Co., Phila.)

Any one intending to undertake the construction of continuous-gum work had better take instructions of some competent dentist who has had experience in the work, as there are many little details which can only be learned in this way.

CHAPTER XVI.

CAST METAL PLATES.

FOR full lower plates these are generally preferable, first because of the *weight*, which is a valuable adjunct of lower sets. Then we have *metal* in contact with the membrane, which is an advantage over rubber, and being a non-shrinking metal (tin and bismuth) cast on a non-shrinking model (plaster and pumice, or sand), furnishes a more perfect fit than by swaging, and as alteration of the margins of lower plates is often necessary, we are able to do it without injuring the appearance of the work, as in gold or continuous-gum.

The process is as follows: Fill the impression with plaster and pumice, or marble dust, equal parts; remove the impression with care, as it is not as strong as pure plaster; form a wax plate, and double the edge $\frac{1}{8}$ inch wide, which will have the appearance, when finished, of a "rim;" invest the model in Watts' or Weston's flasks, using equal parts plaster and pumice or marble dust; when hard, warm slightly and remove the wax. Now cut gates in the plaster, about $\frac{3}{16}$ inch diameter, from the extreme point of each heel, opening into the flask gates; apply heat gradually till *all moisture* has disappeared, evidence of which

can be had by holding a hand-mirror over the plaster. Then close the flasks, apply the clamp and pour the metal from an iron spoon. When cool, finish with coarse file and sand-paper. Now spur the surface with a graver quite deeply. Arrange the teeth as in a rubber set, and attach with pink rubber and finish.

CHAPTER XVII.

VULCANIZED RUBBER.

ARRANGE on the plaster cast a wax plate,—or wax and gutta-percha plate is preferable; arrange a rim of wax on it, and get a "bite," to show the impression of the lower teeth and relative position of the jaws.

If a full upper and lower, arrange the lower wax and trim by the mouth to the right length; then place the upper and obtain a closure, and while in position make several lines in the wax; remove and trim and replace to see if the closure is the same each time. It is not necessary to attempt to secure the proper fullness and length in the wax; this will have to be done when arranging the teeth, with the

patient in the chair, whether full or partial cases, as it is only by the mouth that the proper arrangement and expression can be secured.

Place the cast and bite in an articulator, to retain the relative position of the jaws, and aid in arranging the teeth.

After arranging the teeth, form the wax for the gum, so as to restore contour of features, trying in the mouth till patient and dentist are satisfied with the result.

Now invest in the flasks. If it is a full case, invest to the margin of the wax; smooth the surface, shellac, and oil; place the other half of flask in place, and before turning the plaster in, with a knife spread some over the surfaces of the teeth, so as to be sure it will fill all spaces between, then turn in a portion of the remainder, and jar, so as to be rid of air-bubbles. To remove the wax, place in pan of cold water over the gas, and as soon as it *begins* to boil remove and separate, and it will be found, usually, that the wax can be easily removed. Then to clean thoroughly, dash hot water on it; cut narrow gates $\frac{1}{2}$ inch apart all around, and scrape the entire surface slightly to insure closure of flasks.

To pack, place the pieces of rubber on a plate of tin or zinc placed over a pan of hot water. If you would be specially accurate of the amount of rubber, measure as follows: Have a glass test-tube, or some

similar utensil; save the wax, roll it up and put it in the tube, filling with water carefully; remove the wax and in its place put the rubber, till the water is at the top again, and then add a little for excess.

Observe, when waxing up, whether one side requires more material than another, and bear this in mind in packing. Pack small pieces behind the teeth, and then use strips, and one piece sufficient in size to cover the palate.

For rubber, the red, colored with bisulphide of mercury, is objectionable; serious results have sometimes followed its use. The black and the maroon are free from deleterious substances. For the surface of the gums use the pink. The color of this is improved by bleaching with alcohol in a glass jar exposed to the sun for half an hour or more.

The palatal surface should be covered with tin foil; cut a piece the proper size, and with a cloth, or tissue paper, rub it to the cast, and it will adhere sufficiently. Then slightly coat with soap, to prevent its adhering to the rubber when vulcanized.

Put the flasks together, and place in the press, immersing both in the hot water; bring gradually together. If you have any doubts of a lack of rubber, open and examine, for, though there may be enough, it may be unequally distributed.

Instead of using the bolts to hold the flask, the "spring-clamp" is preferable.

As to vulcanizers, you must take your choice. Some are more easily adjusted and handled than others. A vulcanizer arranged with a steam gauge is more reliable than one with thermometer attached.

If the rubber is very *thick*, the heat should be applied more slowly than with thin rubber, to avoid its becoming porous. The black rubber requires lower temperature and longer time. In fact, in this way all rubber is stronger, so that instead of vulcanizing at 320° for 45 or 55 minutes, 280° to 300° for two hours produces tougher rubber.

On opening the flasks, try the rubber by breaking off a gate, to see if it is hard enough.

With coarse file, shape the margins and surface of gums; then use the large bur for the lingual surface, using the calipers to avoid making it too thin, yet give the patient all the space possible for the tongue, without sacrificing strength. With thin, sharp chisel trim around the necks of the teeth, and with small, sharp points between. Use the *round* scraper for the surface. Sand-paper (No. 0 or 00) thoroughly, and finish with pumice, either with a pine stick in the hand or felt cone, or both, and finally with *small, soft* brush wheels.

A partial case, where there is no rubber outside the gums, should be invested in the deep part of the flask, covering the teeth entirely.

CHAPTER XVIII.

CELLULOID.

THE process for celluloid is similar to that for rubber, but requiring a different flask. Instead of packing a soft material in the molds, as contained in the flasks, to be hardened, a hard material is placed between, to be softened and pressed into place.

The celluloid is prepared in blanks, of various sizes and shapes. When the case is ready for the blank, it is placed between, sometimes altering by filing, or heating in boiling water and bending, so as to bring into better shape for the flasks.

There are two methods of applying heat, dry and steam. There are various appliances for this purpose. The latest and most perfect is the New Mode Heater, where, though steam is used, the case is in a dry air chamber.

The cheaper appliances for this work are not desirable, and have long since been abandoned by most of those who have used them. I have given them a six-years thorough trial.

Finish the same as rubber. It should never be allowed to remain out of the mouth without being placed in water, as it has a tendency to warp.

REPAIRING.

GOLD OR SILVER.

REMOVE the remains of the broken tooth, and, with plate nippers and file, remove the backing. Select a tooth, and wax it into place; insert in plaster and sand, or marble dust, and put on the backing.

These repair cases should be heated slowly, taking an hour for the purpose, then solder. Cool off slowly, and it will be a rare occurrence that a tooth cracks. This has been my experience.

If the plate has cracked and *spread*, let it remain in that condition, as it has followed a change in the gums. Place borax on the under side, and lay a piece of wet tissue paper over the crack on that side, so the plaster will not get into the crack. Scrape the surface of the plate; invest and fit a small piece of plate over the crack; lay the solder in small pieces along the sides; heat and solder. If your solder is right and you give it proper heat, it will not only flow under the piece of plate, but also into the crack.

RUBBER.

Remove the broken tooth, and file away the rubber back of it; select a tooth that will go into the impression of the neck of the former tooth, and wax into place; insert in the deep half of the flask; remove the wax, scrape the surface of the rubber, and

apply a little of the solution of rubber in chloroform, and pack; no holes nor dovetails are ever needed.

If the plate is cracked, cut away the length of the break, from each side, ¼ inch, and nearly the thickness of the plate at the break. If the break has extended to the outer edge, under the teeth, remove one of the teeth, cut away a portion of the break, wax the tooth into place, and wax over the break, invest, and wash out all the wax, and, if necessary, remove the tooth, and pack the rubber back of it, then replace and pack elsewhere, and vulcanize.

In repairing a partial lower, carefully place the fractured ends together and wax into place; insert and cut away the rubber for a space of ¼ inch each side of the fracture, and at the fracture to its full depth; pack as above.

CELLULOID.

Prepare as in rubber, and after removing the wax, scrape the surface, apply camphor, and place a piece of celluloid, wet with the camphor, where needed, and put into the press; apply a strong heat, and press into place.

CHAPTER XIX.

SELECTION AND ARRANGEMENT OF TEETH.

IN no department of dental practice is more skill, judgment, and experience needed than in this; and in none is there so little manifest, if we judge from the average artificial dentures in wear, especially full sets.

Dr. W. W. Allport, of Chicago, well expressed it in an address before the Boston Academy of Dental Science:

"He who has but moderate ideas of symmetry, harmony of expression, and color, is constantly pained by the lack of that artistic selection and arrangement of artificial teeth which serve to restore to the face the shape and expression left on it by the Creator, the absence of which in artificial dentures stamps him, who should be an artist, an *artisan*, as *a mere mechanic—a libeler of the soul—a deformer of the human face divine.* That mechanical dentistry should have very largely fallen into the hands of this inferior class of practitioners will hardly be wondered at by those who have watched the history of this branch of the practice. For so simple are the modes of attaining tolerable mechanical results, with the methods now usually employed in this department, by the use

of rubber plates and 'gum sections,' that one possessing a high order of appropriate talent is seldom found devoting much time to it."

It is difficult to give oral or written instruction on this subject; it requires the clinic, often repeated. As we are at work on the natural teeth, we should study the subject from that standpoint.

The indiscriminate use of "gum sections" is largely responsible for many failures; for it is impossible to secure proper results, in all respects, where they are used. Their appearance is sometimes an outrage on the human face.

I long ago ceased to use them, using instead plain teeth and pink rubber gums. The question is asked by dentists, "Suppose your patient says she wants a more natural-looking gum?" I tell her it is better to sacrifice somewhat on the *color* of the gum than so much in other respects, by the use of gum teeth. I never yet have had to change the teeth in such cases.

I arrange the teeth and a wax gum, and tell the patient that the wax will be replaced with a gum, but do not say what kind, and they seldom speak of it afterwards.

If there is prominence of the upper jaw and short lip, the worst class of cases to deal with, the gum teeth are utterly out of place, because while a *porcelain* gum is a necessity, it must be very *thin*, *high*, and *seamless*. In these the continuous-gum process is the

only available one, as by it a thin gum can be secured and yet be strong, because it is baked to the plate.

In selecting teeth, if there are teeth remaining in the jaw, there is little difficulty, because it is only necessary to match, in shape and color, these natural teeth.

Do not use gum teeth unless it is absolutely necessary. If it is, look for teeth with the gums extending but a short distance below the neck of the tooth, as the natural gum has receded and needs to be matched in this respect. The corners of the gum on a single tooth should be rounded and ground, to match nicely the natural gum. Generally there is not room for plate behind the gum, without making the gum too thin, or preventing the setting of the gum sufficiently far back to match on to the natural gum. The gum as well as the teeth should match in shade.

As far as possible, select front teeth with the pins *perpendicular;* occasionally the bicuspids and molars require "cross" pins.

In *partial rubber* sets, the rubber can often be used for gums, and when possible, it is better.

If the bite is so close in front there is not room for the thick rubber teeth, select a plate tooth, and solder a backing, with a foot-piece that can be enclosed in the rubber.

If the bite is very close over the lower posterior

teeth, make use of cuspids, or else what are known as "crown" teeth, instead of bicuspids and molars, and have the lower teeth close on a rubber surface.

In case of a gold plate, when this condition of things exists, attach the teeth with rubber, or make a shoulder of gold to bite on.

In the selection of teeth for full upper sets, the lower are usually a guide in color and size. I say in size, in this way: the upper teeth, when properly articulated, should be so arranged that the cusp of the lower cuspid is between the upper lateral and cuspid; so that upper teeth which do this it may safely be assumed are the size of the natural ones. This allows of the interlocking of the bicuspids, as nature arranges for. If, in the preparation of the mouth, there should be extracted a central incisor, be sure to retain it as a guide in the selection of artificial teeth. The patient will sometimes insist that you have selected teeth larger than the natural. I have often in this way shown patients that I have selected teeth no larger, and sometimes a trifle narrow, when they have supposed their new teeth were larger.

There is a great tendency to use *small* and *white* teeth, which often give an insignificant expression to the mouth, the patient looking as though wearing deciduous teeth. I sometimes remind them that it is time they had shed their baby teeth.

The dentist must be guided by the general appearance of the natural teeth. The study of physiognomy and temperament is of great value in deciding what to do when *all* the natural teeth are missing. As a guide, I have prepared the following table, abbreviated from the elaborate one of Dr. J. Foster Flagg's, which will be found serviceable. Of course there are variations from these, as there are combinations of temperament.

	BILIOUS.	SANGUINEOUS.	NERVOUS.	LYMPHATIC.
	Tall, angular, Square-built.	Full, firmly Rounded, Robust.	Delicate, Slightly built.	Bulky, clumsy.
CRANIAL CONTOUR	Angular, high cheek bones.	Rounded and Full.	Oval.	Flat-faced.
HAIR.	Black and curling.	Golden to light chestnut.	Brown, wavy, fine.	Coarse, straight, drab.
EYES, ...	Black.	Blue.	Dark brown.	Gray.
LIPS, ...	Large, Brownish, Purple.	Ruddy and full.	Fine, grayish pink.	Large, not shapely.
TEETH, SHAPE, .	Large, longer than wide, Angular.	Well proportioned, curved and rounded.	Long, almond-shaped.	Large, width predominating.
TEETH, COLOR, .	Brownish, Yellow, Opaque.	Straw, yellow, translucent.	Pearl-blue, translucent.	Dark gray, opaque.

All teeth are variably yellow at the neck (some very slightly). They become darker from the cuspids to the posterior. The cuspids are always more yellow than the incisors, and the bicuspids and molars darker still.

This rule, however, is not followed by the manufacturers, but the dentist, in matching partial sets, at least, should see that the *posterior* teeth are the *darker*. Usually, there is more yellow in the lower than in the upper teeth.

It is not, however, always possible to secure just the shade required from the stock to which you have access; neither is it the case in the large stocks, for in shades there seems to be a "screw loose" somewhere in the manufacture of mineral teeth. This is partly because so many dentists are indifferent, or do not know what is proper. If dentists had more cultivated tastes and were more particular, so as to make an imperative demand for better shaded and shaped teeth, they would speedily be made.

There are certain general directions that may be given for the *arrangement* of the teeth.

First, in length, avoid too short teeth, especially in full upper and lower sets; they should be in proportion to the length of the face; they should neither be so long as to give the lips a stretched appearance, nor so short as to be hidden, or to compress the lips, as in an *aged* look.

If the upper lip is short, the natural teeth show much more than when it is long. Some persons can scarcely cover the natural teeth; they show the whole length of teeth and much of the gum. If the upper lip is very long, the natural teeth do not show at all.

The lower teeth do not generally show as much as the upper; seldom are the gums seen.

Rarely allow a *drawn-in* appearance to the upper teeth. It sometimes occurs in the natural organs, but is a deformity, like some other irregularities, not to be followed. The teeth, as a rule, should stand perpendicular, avoiding either an inward or an outward slant. Of the six front teeth, the cuspids should generally be the most prominent, especially at the neck. The bicuspids should drop inside a trifle of the range of the cuspids, and from there back be nearly on a straight line.

There are various irregularities of the natural teeth; such as over or under-lapping of the laterals and centrals. If it is a pointed jaw, and the lower front teeth are contracted, the centrals should be the most prominent, and the laterals *dropping back* a little, and the cuspids still more.

If the arch is broad, the laterals should overlap, if not in a line with the centrals. We should set the teeth apart in some mouths where there is plenty of room, and close or even lapping when there is a small arch, and in some mouths make the teeth quite irre-

gular, if it is a person of large build, especially if his lower teeth are crowded and irregular.

Never consider it necessary to make the teeth absolutely ugly, to look natural.

For a lady of regular features, irregularities, except slight ones, are to be avoided. Nothing more than the setting apart, or slight tipping of a lateral, is needed.

It is the upper teeth which mainly give expression to the features, therefore they should have our chief attention. Where both sets are being inserted, they should always be arranged together.

In the arrangement of the lower teeth, after the length is decided on, the width of the six anterior teeth should be such as to bring them within the proper compass for a correct articulation; that is, so the *point* of the *lower cuspid* comes between the upper lateral and cuspid. Then there is no difficulty in securing a correct apposition of the bicuspids and molars. To do this, it is usually necessary to crowd the lower teeth, unless the uppers are large. The over-lapping and irregularity of the lower teeth are generally in the line of nature, and always give a natural appearance.

Of all places, gum sections are most out of place on the lower jaw. The necessity of setting the teeth sufficiently in over the ridge makes it generally impossible to get them there without grinding away the

gum too much ; with them it is next to impossible to give the proper arrangement of the teeth so as to secure a correct expression and articulation. If gum sections are used on the upper jaw, they should at least be discarded on the lower.

The utmost stress must be laid on the correct closure of the teeth. There are more failures arising from this cause than from misfits. The jaws should close so as not to disturb the position of the plates, otherwise there is trouble. It should be borne in mind that whenever the patient swallows, as they are constantly doing, without thought of it, the jaws close tightly, and this, of course, displaces the plates if the teeth are not properly articulated.

A common fault is the interference of the anterior teeth. When they strike before the posterior teeth do, the upper plate is crowded forward and down from the rear.

The six anterior should never meet, except where mentioned later. When, as is usually the case, the upper close outside the lower, they should drop not more than $\frac{1}{3}$ inch below the ends of the lower, and there should be at least $\frac{1}{8}$ inch space horizontal between them, and even then, in time, by the settling of the gums, they will come together, and need grinding to prevent strong pressure.

If it is a protruding lower jaw, let the upper teeth be arranged over the ends, but not meeting; the back

teeth being long enough to take the pressure off the front teeth. In excessive prominence of the lower teeth, arrange the ends of the upper teeth inside of the lower, as nature had done; then if they do meet slightly, the pressure will be favorable to the upper.

The posterior upper teeth should never be allowed to drop on an inclined plane from the cuspid to the molar. The expression is bad, and the possible advantage claimed by some in use, is not sufficient compensation.

The manner in which the *surfaces* of the bicuspids meet is of importance. The *posterior side* or slope of the lower bicuspid should press on the *anterior* side of the upper. The lower anterior teeth should be set well in over the ridge, otherwise there is undue prominence of the lower lip.

The pressure should fall mainly on the bicuspids and first molars, not allowing the second molars to meet, because when there shall be a closer approximation of the jaws by the settling of the gums, these teeth will feel the pressure excessively, and there will be irritation of the membrane and crowding forward of the plates; this will be felt specially on the *lower* jaw, and require the shortening of these molars.

If there are wisdom teeth standing alone on the lower jaw, they are usually inclined forward, so the surface is often at an angle of 45°. They should

be avoided in arranging the upper teeth, for if they meet it will result in crowding the plate forward, and the difficulty will constantly increase.

A difficult condition of things is met when a full upper set is inserted, and there remains on the lower jaw the six anterior teeth, and on one side one, or perhaps two, bicuspids, and nothing on the other. Here there is nothing to counterbalance the pressure on these bicuspids. The insertion of partial lower would be of no value, for they would soon yield to pressure; but, if these bicuspids were extracted, and on both sides were artificial teeth, the difficulty would be removed; the patient would have a good masticating surface, and no displacement of the plate. In such instances the best interests of the patient should be consulted, and not mere sentiment about extracting sound teeth.

If *all* the teeth remain on one side and none on the other, make a virtue of necessity, as there is so much involved in the sacrifice. Build a biting surface for the lower cuspid; if it is a rubber plate, insert a small piece of a tooth, with the pins in it, in the rubber back of the upper cuspid.

The articulation of teeth is sometimes very difficult. Great care must be exercised that there is no one tooth nor one side meeting before the other.

When the lower anterior teeth are much longer than the bicuspids, shortening of them is always de-

sirable, or sometimes building up these bicuspids or placing crowns on them is essential. If this is not done, make the upper bicuspids sufficiently long to throw the jaws apart, so that the upper will not close too far below the ends of the lower. If the surfaces of the bicuspids are *inclined planes*, grind, if possible, so as to make a square biting surface.

The general position of the lower posterior teeth should be such that the force of the pressure is toward the centre of the upper ridge, and not outward. It is usually more difficult to properly arrange the lower set than the upper.

The two sets should always be arranged together, then finish one and try in, and correct any faults arising from the two sets in wax arranged at once.

The arrangement or disposal of the artificial gum is often overlooked; in fact, with the gum sections it is not possible to arrange so as to properly restore the contour of the lips. In all cases the fullest and highest point should be over the cuspids; this would often relieve the undue fullness under the nose, so common in most dentures.

In 95 per cent. of mouths, there is more depression at the *left* side in the region of the cuspids than at the right, so that the teeth need to be extended lower from the plate, to secure a proper range with the lips; and also more thickening of the artificial gum, to restore the contour of the lip.

TEMPORARY WORK.

Patients dislike to go very long without teeth, and it is unnecessary. Long experience has satisfied me that, as a rule, the teeth should be inserted within 48 hours after extraction, taking the impression as soon as the bleeding has stopped, and before the gums have swollen.

When the front teeth or their remains have just been removed, I make use of the socket to insert, for a short distance, the neck of the artificial teeth, giving, of course, a natural appearance to them.

There is rarely room for an artificial gum in temporary cases, and then only that furnished by the rubber plate being allowed to cover the alveolar ridge.

On the lower jaw, if many teeth have been extracted, it is better to wait till the gums are healed; but if the patient is desirous of having them at once, make them; if the remains of the front teeth have just been removed, set, as in the upper, the necks of the teeth into the sockets. It is seldom possible to cover the outside of the alveolar ridge with the plate, without projecting the lip.

Injury comes to the ridge by wearing the temporary plates too long. It causes excessive absorption where it presses too hard, and is quite annoying. The patient should visit the dentist occasionally that changes may be made in the plate or grinding surfaces of the teeth as the gums settle.

CHAPTER XX.

ADJUSTMENT IN THE MOUTH.

AFTER the work is completed, be careful to adjust it in the mouth so as to leave as favorable an impression as possible.

If it is a clasp plate, see that the clasps spring into place so as to hold, and yet not be injuriously tight. See that the teeth are articulated in partial sets, so that the pressure is thrown on the natural organs.

In adjusting a full set, the greatest care must be taken to see that the articulation is correct. Then say to the patient, "If you find the plate hurts you, call soon and have the excessive pressure relieved, for it is not necessary to suffer; relief should be afforded at once." It is advisable to see the patient in a few days to be sure the articulation is correct. Too much stress cannot be laid on this point.

There are mouths where all the conditions are favorable, so that it is easy to secure results satisfactory to the patient as well as to yourself. There are mouths where *all* the conditions are unfavorable, and after the dentist has done all that care, skill, and experience can accomplish, the patient will complain, and wonder why the teeth do not work as satisfactorily as Neighbor Blank's. It is often because the conditions of the mouth are entirely different or unfavor-

able to the best results. The only thing is to impress the importance of patience and constant use of the teeth. Time and perseverance will accomplish wonders.

A few hints may be given on the use of artificial teeth, as, for instance, in biting an apple; if the teeth are used as the natural teeth are, they are liable to be thrown down from behind. The new teeth must be pressed *against* in biting. In masticating, if the food is all placed on one side, the leverage is such that the plate is displaced; and yet, in time, the patient will learn to eat on one side; but at first divide, and with the tongue place the food on both sides.

EXTRACTS OF NOTES ON ORTHODONTIA, WITH A NEW SYSTEM BY REGULATION AND RETENTION.

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Read before the Ninth International Medical Congress, Dental Section.

IN studying the conditions by which we may best accomplish the movements of the teeth, we may simplify the process if we remember the movements in the line of the arch, which are five: forward, backward, inward, outward, and partial rotation. These, and their slight modifications, with the exception of elongation and depression, which are rare, are all we are called on to perform. The principles governing all of these movements are the same. So that, by understanding the principles governing one, we may comprehend all.

In applying force to a tooth, it should be sufficient to accomplish the movements as rapidly as is consistent with physiological law. When pressure is once

applied, it should be continued without relinquishment, for there should be no retrogression of the tooth.

The appliance for accomplishing the movement of a tooth must be so perfect in design, construction, application, and operation, that there should be no need for its removal till its object is accomplished.

RETAINING APPLIANCES.

After the mal-posed tooth has been moved into the desired position and proper occlusion secured, it should be firmly supported and retained till it has become firm in its new socket. "The importance of a steady support and rest while the tooth is becoming firm is well illustrated," says Guilford, "in the necessity of placing a fractured limb in immovable splints."

A strip of 32 to 36 gauge platina, about $\frac{1}{8}$ of an inch wide, is made into a loop and slipped over the tooth to be banded. The ends are now grasped close to the tooth with a pair of flat-nosed pliers, and the band drawn tightly round the tooth, a strong burnisher being applied at the same time to still further make it conform to the shape of the tooth. A small bit of solder is now placed in the band at the junction, and all carried in contact with the flame of the soldering lamp. After it is soldered the ends are chipped off, and the band is now complete and ready for any attachments which may be made; after which it is cemented in position on the tooth.

For accomplishing the different movements of the teeth, I use the following simple appliances:

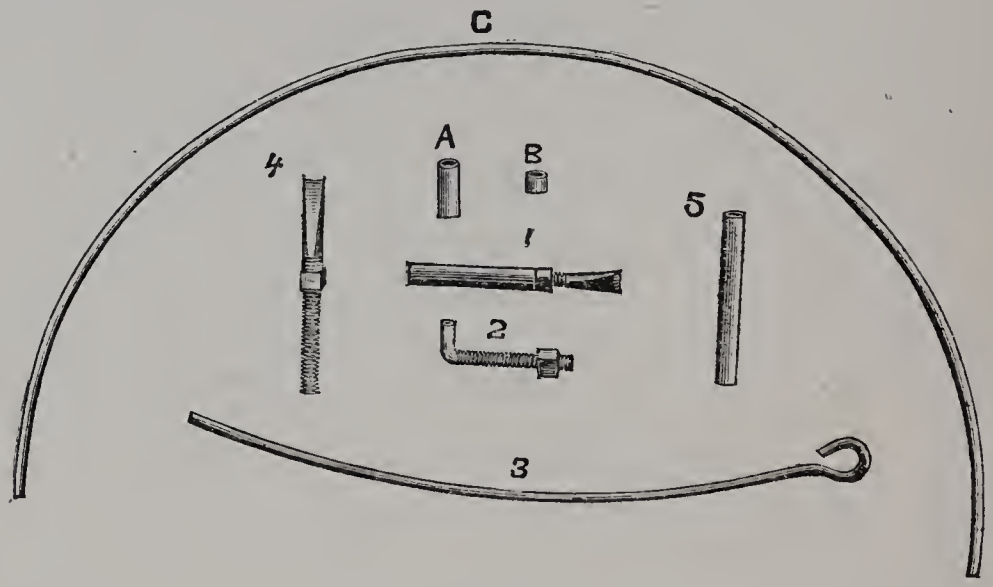

Fig. 1.

Fig. 1. shows two forms of the screw: one for pushing, as shown at 1; one for pulling, as shown at 2; and a lever for rotating, as shown at 3. For making and using these appliances, use Stubb's steel wire of two sizes. You will also need jewelers' gold-plated wire and hollow wire, or, as it is known among jewelers, "joint wire," which may be of either gold or silver, and a few pieces of piano wire. The screw for pushing is made by cutting a thread on a piece of Stubb's steel wire of the desired size and length. One end of this screw is beaten flat, and to the other end is screwed a small nut made of platinized gold. This complete is shown at 4. A piece of the joint wire is now sawed off the desired length. The screw is slipped into this

pipe, and the whole is now complete and ready for use, as shown at 1. This style of screw may be made any size or length ; the largest I have yet made being $2\frac{1}{2}$ inches in length, the shortest $\frac{1}{4}$ inch.

The traction screw is made of Stubb's steel wire, in a similar manner to the screw just described, with the exception that one end of the screw is bent sharply at right angles. The screw complete is shown at 2. The entire length of the screw is about $\frac{3}{8}$ of an inch, the angle or bent portion 3-32 of an inch.

The lever is made of a piece of piano wire (No. 13), about $2\frac{1}{2}$ inches in length, bent at one end into the form of an eye. It is shown complete at 3.

Rotation by means of this instrument is accomplished by banding the tooth to be rotated. Before cementing the band in position on the tooth, a piece of joint wire $\frac{1}{4}$ inch long is soldered on to the band on the labial or buccal surface at right angles to the axis of the tooth. The band is now cemented in position on the tooth. The straight end of the piano wire is inserted into the little pipe in the band. The other end sprung round and made fast by a wire ligature to the tooth nearest the eye in the end of the lever. Fig. 2. shows an incisor being rotated by this method.

After the tooth has been moved into position it is retained by removing the spring and inserting a piece of the gold plated wire into the tube from the opposite side, long enough for the end to rest on the labial

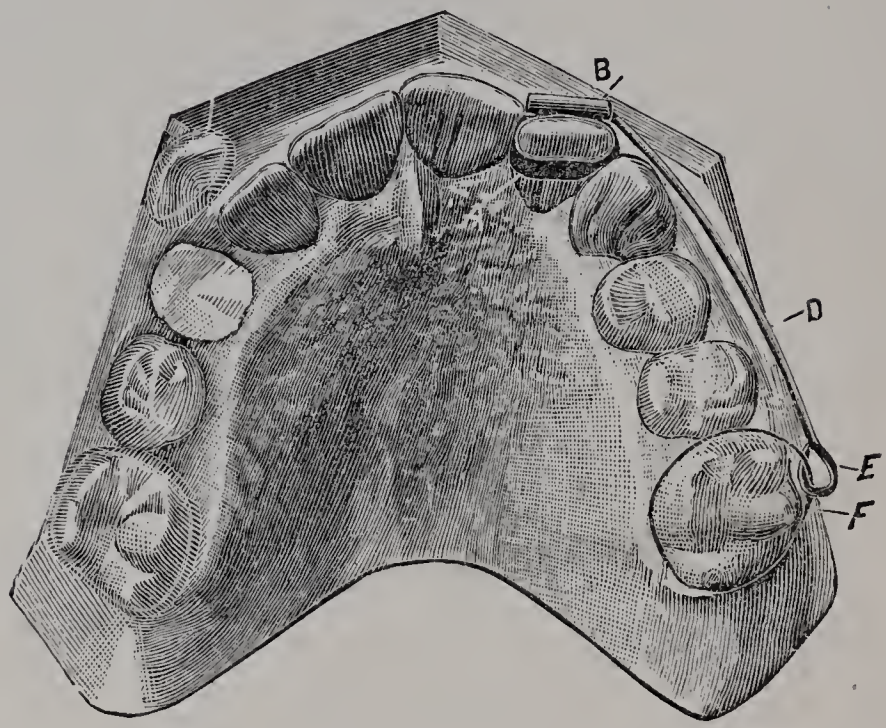

Fig. 2.

surface of the tooth adjoining, as shown in Fig. 3. The piece of wire is prevented from turning or working out, by passing a fine drill through the pipe and one side of the wire, and inserting a neatly-fitting piece in the hole thus made.

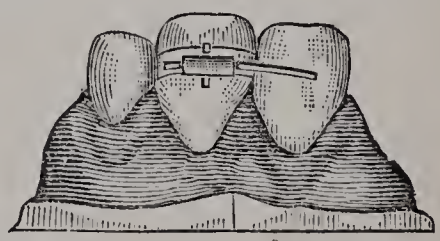

Fig. 3.

For accomplishing the movements of a tooth from *within outward* into the line of the arch, the screw first described is used in the following manner: The tooth to be moved is banded and piped in the same manner as described in rotation; then into the pala-

tal side of the band is formed a slat, into which is inserted the flat end of the screw. Resistance is gained for the base of the screw by selecting a sufficient number of teeth to completely resist the pressure of the moving tooth.

These teeth are banded and piped close to the gum, and on a line with it. A piece of the gold plated wire is threaded through these little pipes, either before or after cementing the bands in position. Against this wire is placed the base of the pipe encircling the screw. A suitable notch is fitted into the end of the

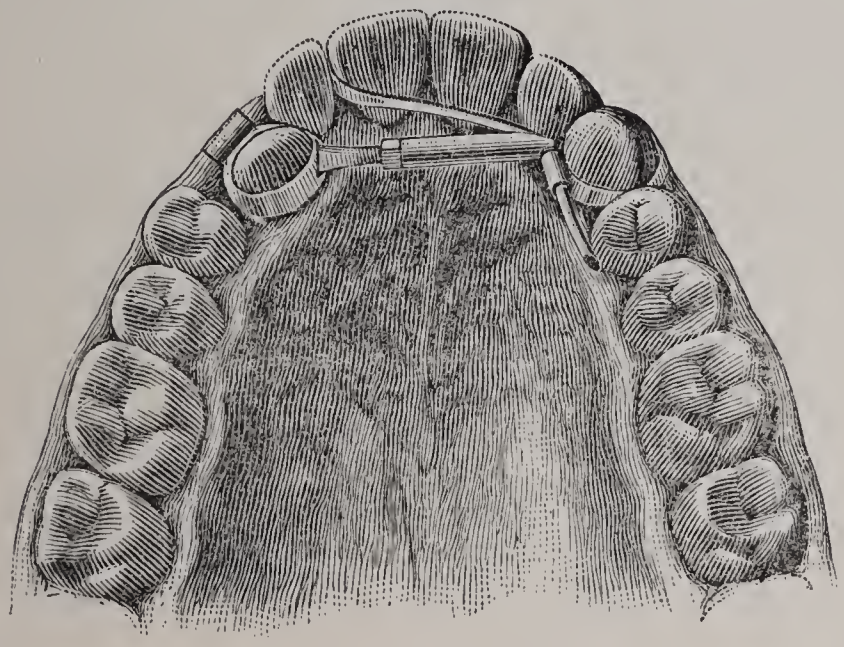

Fig. 4.

pipe, to fit the wire and prevent it from slipping; or, if this wire of resistance is placed on the outside of the arch, as may be done with advantage in many

cases, the base of the pipe is rested against one of the bands encircling one of the teeth. It is prevented from slipping by soldering it in position, or by plugging the end of the pipe, and filing it to a sharp point. The point rests in a pit formed in the band. Fig. 4 shows the screw in position in moving an inlocked cuspid.

Force is applied by tightening the nut with a small wrench after the tooth has been moved into the line of the arch. If the movement of rotation is necessary the lever is applied, after which it is retained by inserting a piece of the plated wire into the little pipe. The end of the wire resting against the outer surface of the tooth on each side is shown in Fig. 5.

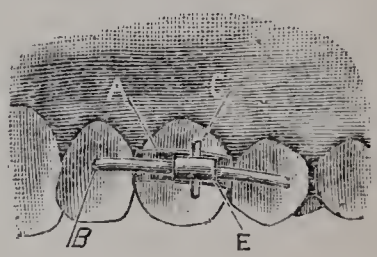

Fig. 5.

The movement of a tooth *inward into* the line of the arch is accomplished by banding the tooth. To the palatal side of the band, close to and on a line with the gum, is soldered one of the little pipes $\frac{3}{32}$ of an inch long. Into this pipe is hooked the angle of the traction screw. Resistance is gained by banding piping on one or more teeth on each side of the tooth to be moved, the pipes being soldered close to and on a line with the gum. Through these little pipes, either before or after cementing in position, is threaded a piece of the plated wire.

Pressure is now exerted by the screw pulling through, and the nut working against the end of another of these little pipes soldered to the wire of resistance. Fig. 6 shows a lateral incisor being drawn into line. The nut is tightened as often as necessary. The end of the screw is snipped off from time to time to prevent its chafing the tongue.

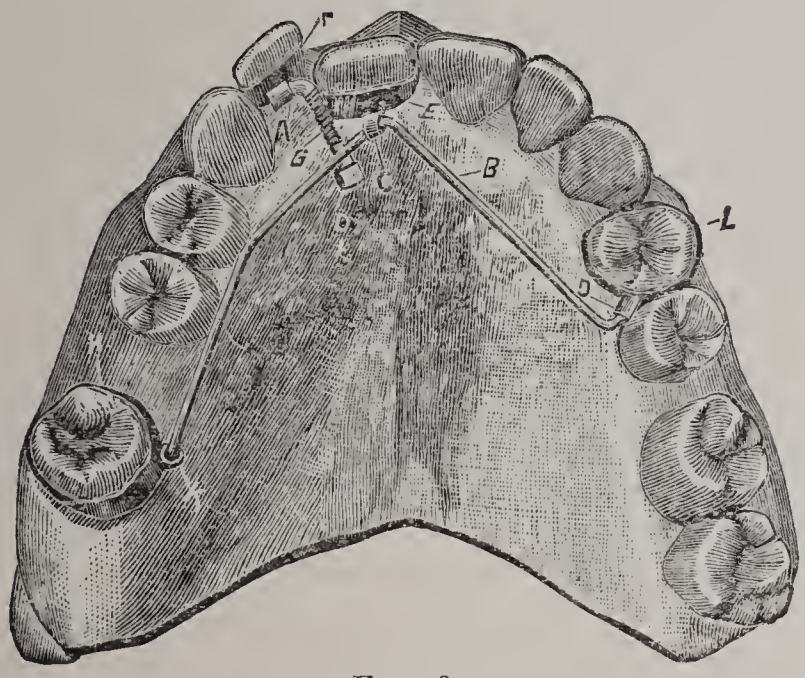

Fig. 6.

After the tooth has been drawn into line, the wire of resistance and the traction screw are removed, and the tooth is retained in position by inserting a piece of the plated wire into the little pipe before occupied by the angle of the traction screw, the wire being long enough for the ends to rest

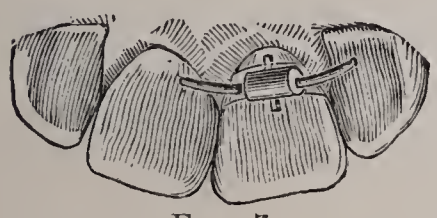

Fig. 7.

against the palatal surface of the tooth on each side, as shown in Fig. 7. The retaining wire is held in position as shown in Fig. 3.

The movement of a tooth backward in a line of the arch is accomplished by banding the tooth to be moved. To the outward surface of the band is soldered one of the pipes $\frac{3}{32}$ of an inch long, at right-angles to the tooth, and line of the arch. Into this

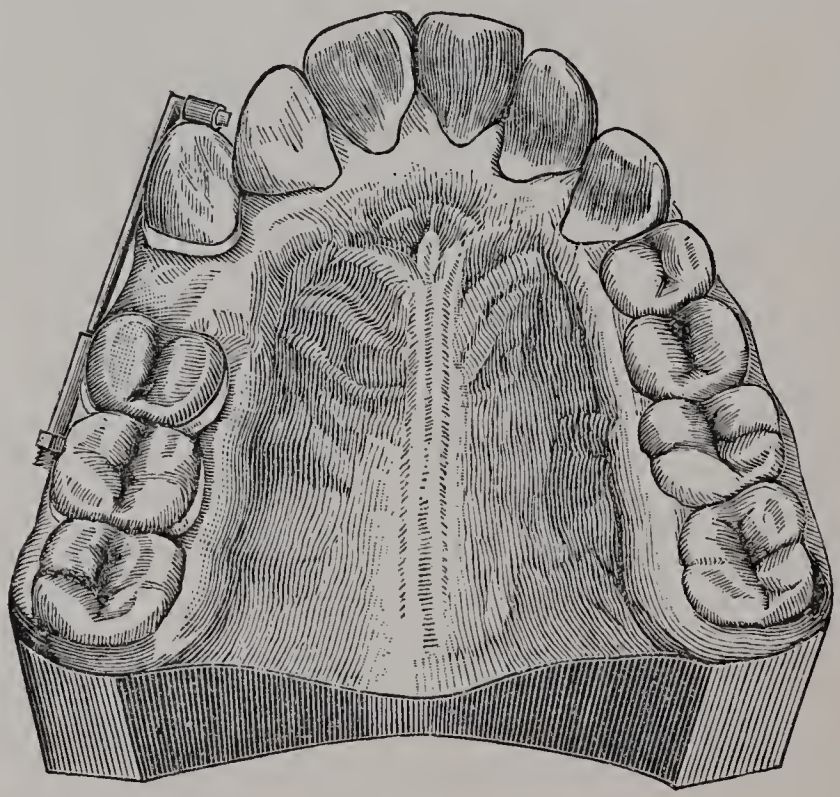

Fig 8.

pipe is hooked the angle of the traction screw. The other end of the screw passes through, and the nut works against, the end of the pipe soldered to the

bands encircling the teeth to be used in overcoming the resistance of the tooth being moved. Fig. 8 shows a cuspid being drawn backward. It will be seen that the movement, tipping, which is the ideal, is thus gained, and though the pressure is exerted on one side of the tooth only, yet rotation is impossible, as it moves backward. It will also be seen that the resistance is complete, as the teeth used for this purpose cannot tip, but must be dragged forward bodily through the alveolus. The screw is snipped off from time to time as it emerges through the pipe and chafes the cheek, or the cheek may be protected by covering the end of the screw with a piece of warmed gutta-percha.

After the tooth has been moved backward the desired distance, it is retained there by the screw being kept in position, or it may be removed and a piece of gold wire inserted in its place.

The movement of a tooth forward in line of the arch is accomplished in the same way, only selecting teeth from the opposite side to be used in overcoming the resistance of the teeth being moved.

The expansion of the arch is accomplished by placing a bar of heaviest piano wire against the palatal side of the arch, one on each side. They are held in position by the ends in front passing through little pipes soldered to bands encircling the cuspids. The *posterior* ends are kept in position by the ends of the

wire being bent sharply at right angles, and hooked into little pipes attached to bands encircling the last molars.

Thus it will be seen that two rigid bars of steel, one on each side, are held firmly in contact with the teeth. As shown in Fig. 10, pressure may be exerted by placing the screw first described directly across the arch. The opposite ends resting against the bars of steel; expansion is gained by tightening the nut on the screw.

A better method of applying pressure against these two bars is to bend a piece of heavy steel-wire to conform to the curve of the arch across from bar to bar. At the side near one end is filed a notch fitting neatly one of the bars which it is to rest against. The other end is beaten slightly flat and a hole drilled through at a point directly opposite the other bar on that side of the arch. Through this hole is placed the screw for pushing, as shown in Figs. 1 and 4. The screw should not be over $\frac{1}{4}$ of an inch in length.

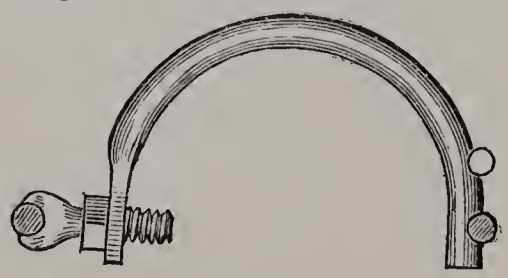

Fig. 9

This appliance is now ready to place in position, as shown in Fig. 9. It is in position in Figure 10.

Pressure is exerted by

tightening the nut. After the nut has traveled the length of the screw, the bent wire is removed and straightened a little that the screw may have more action. It will be seen in the engraving that *two* of these screws and braces are used, one to remain in position while the other is being straightened, thus preventing the teeth from moving back, as would be the case if but one was used.

These braces are moved along the bars forward or

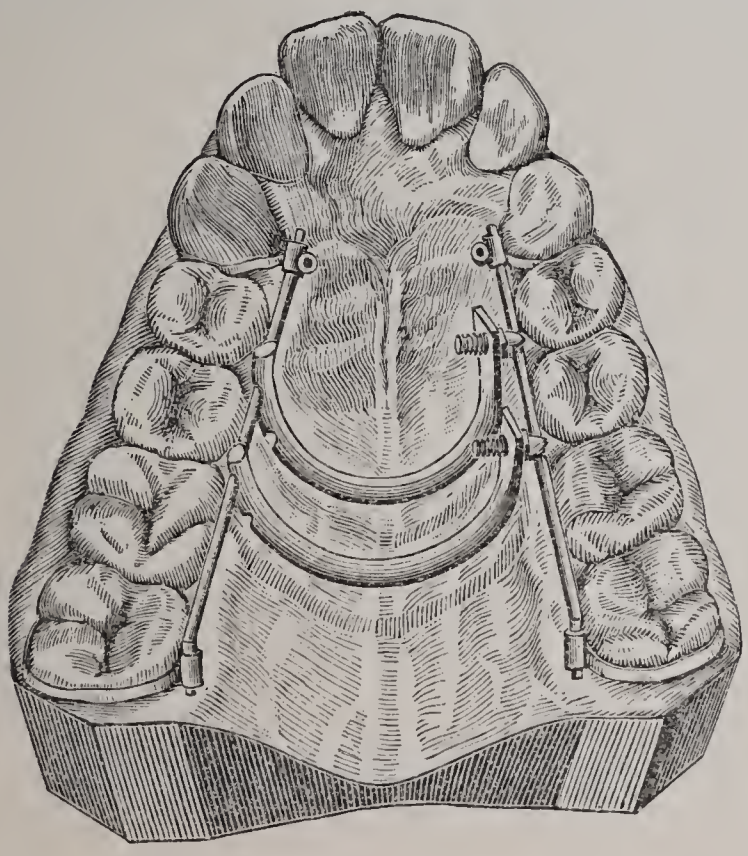

Fig. 10.

backward according as pressure is needed. After the sides of the arch have been pressed apart the desired

distance, they are retained by a straight bar passing across the arch from cuspid to cuspid, the ends being bent sharply at right angles and hooked into little pipes, soldered at right angles to the pipes already described as attached to bands encircling cuspids.

The incisors are drawn into line by means of the lever and traction screw, this cross-bar serving as the wire of resistance for the traction screw to pull to.

This method of expansion may be applied to the lower arch as well, as little interference is offered to

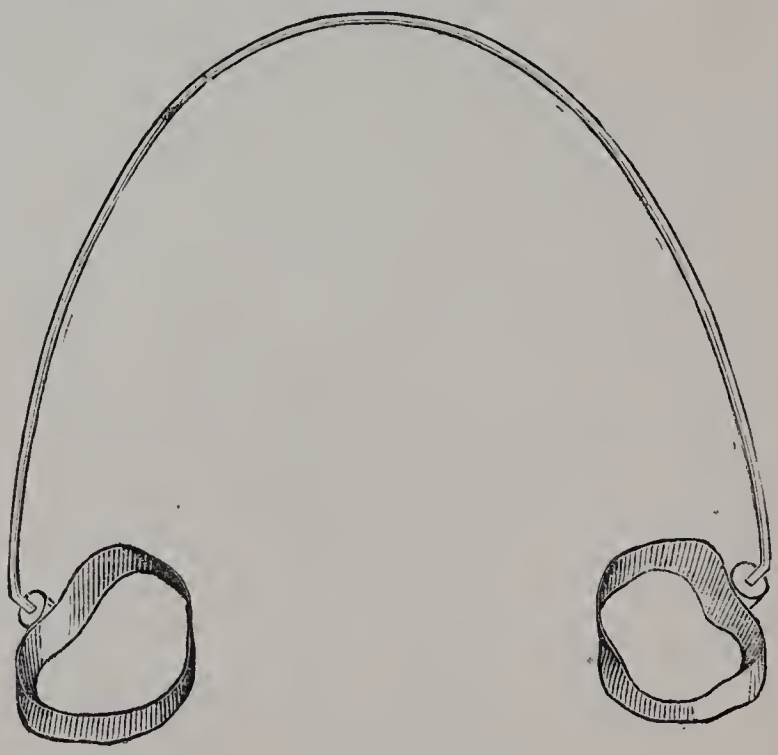

FIG. 11.

the movement of the tongue. If several teeth are to be retained in position, one molar on each side of the arch is banded and piped on a line parallel with their

axis. Into this pipe is hooked the ends of a piece of the plated wire, bent to conform to the shape of the arch and snugly encircling it. To this wire is attached by bands and pipes such teeth as should be supported. Fig. 11 shows such a retaining appliance.

Such is the general method of using these three appliances, but the different ways in which they may be applied are almost innumerable, each case requiring some slight modification.

The greatest care and accuracy should be observed in the construction, application and use of these appliances. The little tube should be of gold and fit snugly the different parts of the appliances passing through them. The rubber dam should always be adjusted about the teeth before fitting and cementing the bands into position, and the cement used should be of the finest quality. The screws may be made of platinized gold, or if of steel they should be nickel-plated.